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Proceedings of a Second Workshop on the Conservation Status of Atlantic Salmon in Eastern Canada

6-9 March 2007
Dartmouth, Nova Scotia

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Chairperson

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February 2008

Compte rendu d'un deuxième atelier sur la conservation du saumon atlantique dans l'est du Canada

Du 6 au 9 mars 2007
Dartmouth (N.-É.)

T.L. Marshall
Président de réunion

Pêches et Océans
Institut océanographique de Bedford
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février 2008

Canada

FOREWORD

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

This document is a product from a workshop that was not conducted under the Department of Fisheries Oceans (DFO) Science Advisory Process coordinated by the Canadian Science Advisory Secretariat (CSAS). However, it is being documented in the CSAS Proceeding series as it presents some key scientific information related to the advisory process. It documents contributions and discussion at a DFO-SARCEP (Species at Risk Committee / *Comité sur les espèces en péril*) sponsored workshop in Dartmouth (March 2007) to complete the development of a 'Conservation Status Report' (CSR) for Atlantic salmon. The CSR could form the basis for a Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report, recovery potential assessment and recovery strategy, and most importantly, enable DFO to implement pre-emptive management measures prior to engagement in any listing process.

AVANT-PROPOS

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

Le présent document est issu d'un atelier qui ne faisait pas partie du Processus consultatif scientifique du ministère des Pêches et des Océans (MPO), coordonné par le Secrétariat canadien de consultation scientifique (SCCS). Cependant, il est intégré à la série des comptes rendus du SCCS car il présente certains renseignements scientifiques clés, liés au processus consultatif. Il documente les nombreuses contributions et discussions auxquelles a donné lieu un atelier parrainé par le MPO-SARCEP (*Species at Risk Committee* / Comité sur les espèces en péril) à Dartmouth (mars 2007) en vue de mener à bien l'élaboration d'un rapport sur la conservation du saumon atlantique. Ce rapport pourrait servir de base à un Rapport de situation du Comité sur la situation des espèces en péril au Canada (COSEPAC), à une évaluation du potentiel de rétablissement et à un programme de rétablissement; mais, avant tout, il pourrait permettre au MPO de mettre en œuvre des mesures de gestion anticipées avant même de s'engager dans un quelconque processus d'inscription sur la liste des espèces en péril.

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SUMMARY

Atlantic salmon (*Salmo salar*) scientists, together with peers and external reviewers, met in Dartmouth, March 6-7, 2007, to examine criteria by which to support the designation of Atlantic salmon Conservation Units for Eastern Canada, convey the status of populations in terms of risk of extinction, and review draft text from the first workshop held in Moncton, New Brunswick, February 13-16, 2006. On March 8-9, 2007, the group was joined by fisheries managers, a habitat manager, and an economist to develop a framework for documenting the threats and harm, review the existing protection, consider potential recovery targets, and as well, examine the social/cultural, aboriginal, and economic significance of the species.

Consensus was reached on the definition of a Conservation Unit (CU) for Atlantic salmon and types of supporting evidence which could be used to delineate the Eastern Canadian anadromous populations into 28 Units. However, no consensus was reached within the 3 DFO regions and the Province of Quebec (PQ) on a common single or set of multiple indicators of status or benchmark breakpoints for classification of populations. Indicators included rate of decline, percentage of conservation requirement met, variations on recruits per spawner, adult returns, target parr densities, and proportion of rivers in a CU occupied by salmon. The 'percentage of conservation requirement met' remained the preferred indicator, although it was recognised that decline criteria is also relevant for assessment and is used by groups such as the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A discussion on trajectories was hampered by the absence of probabilistic analyses on any population, while a 'Target for Recovery' was unanimously selected as the conservation requirement.

A table for listing threats and evaluating a degree of harm on the spawning population was developed and tested for four CUs at the workshop. Each Region and the Province of Quebec was encouraged to complete the table for each CU within their jurisdiction for inclusion in the Report. Economic significance and activity were also discussed, the latter for each CU. A special tabulation of activity dedicated to Atlantic salmon within the 2000 Survey of Recreational Fishing in Canada revealed that some 48,000 anglers expended 435,000 fishing days and $91M in pursuit of the species. Inclusion of a base year, such as 1985, prior to recent declines in abundance and fishery restrictions was unavailable at the workshop but deemed to be instructive in future. Non-use river values (canoeing and viewing salmon) garnered significant discussion and support for inclusion in the final report.

SOMMAIRE

Les scientifiques spécialistes du saumon atlantique (*Salmo salar*) se sont réunis en compagnie de certains de leurs pairs et d'examinateurs externes à Dartmouth les 6 et 7 mars 2007 pour examiner les critères de désignation d'unités de conservation du saumon atlantique dans l'est du Canada, faire connaître l'état des populations de saumon eu égard à leur risque de disparition et examiner l'ébauche d'un texte issu du premier atelier tenu à Moncton (Nouveau-Brunswick) du 13 au 16 février 2006. Les 8 et 9 mars 2007, des gestionnaires des pêches, un gestionnaire de l'habitat et un économiste se sont joints au groupe pour élaborer un cadre documentant les menaces et les risques de dommages qui pèsent sur les populations considérées, examiner les mesures de protection qui sont en place, envisager des objectifs de rétablissement possibles et examiner l'importance socioculturelle et économique de l'espèce ainsi que la place qu'elle occupe dans les communautés autochtones.

Les participants sont arrivés à un consensus sur la définition d'une unité de conservation (UC) du saumon atlantique et sur le genre d'éléments d'information sur lesquels on pourrait se fonder pour subdiviser les populations anadromes de l'est du Canada en 28 unités. Toutefois, les trois Régions du MPO et la province de Québec ne sont pas parvenues à s'entendre sur un indicateur ou un ensemble d'indicateurs communs de l'état des populations ou sur des points de référence permettant de classer les populations. Les indicateurs cités comprenaient le taux de déclin, le pourcentage d'impératifs de conservation atteints, les variations dans le nombre de recrues par frayeur, les montaisons d'adultes, les densités cibles de tacons et la proportion des rivières d'une UC occupée par des saumons. Le « pourcentage d'impératifs de conservation atteints » restait l'indicateur de prédilection, quoiqu'on ait considéré aussi le critère de déclin comme un élément d'évaluation pertinent, d'ailleurs déjà utilisé par des organismes comme le Comité sur la situation des espèces en péril au Canada (COSEPAC). Une discussion sur les trajectoires s'est heurtée à l'absence d'analyse de probabilités, cela pour toutes les populations, mais on a unanimement retenu comme impératif de conservation un « objectif de rétablissement ».

Au cours de l'atelier, les participants ont établi un tableau recensant les menaces et évaluant l'importance des dommages occasionnés à la population de frayeurs et ils en ont fait l'essai sur quatre UC. Chacune des Régions ainsi que la province de Québec étaient invitées à remplir ce tableau pour chaque UC relevant de leurs compétences respectives, aux fins d'intégration au Rapport. On a aussi discuté de l'importance économique des populations et de l'activité à laquelle elles donnent lieu dans chaque UC. Un examen particulier de l'activité consacrée au saumon atlantique d'après les résultats de l'enquête de 2000 sur la pêche récréative au Canada a révélé que quelque 48 000 pêcheurs sportifs ont consacré 435 000 jours de pêche et 91 M$ à la pêche de l'espèce. Les données d'une année de base comme 1985, soit avant les récents déclins de l'abondance et restrictions sur la pêche, n'étaient pas disponibles à l'atelier, mais on a estimé qu'elles seraient utiles à l'avenir. Les valeurs non utilitaires (canotage et observation du saumon) ont suscité beaucoup de discussions et on a jugé qu'elles devaient figurer dans le rapport final.

INTRODUCTION

The *Species at Risk Act* (SARA) Secretariat of Fisheries and Oceans Canada (DFO) requested that DFO Science begin the development of a Conservation Status Report (CSR; Appendix 1) for Atlantic salmon (*Salmo salar*) in 2005-2006. The report would be the basis of a pre-COSEWIC (Committee on the Status of Endangered Wildlife in Canada) advisory review [DFO Regional Advisory Process], which in turn would support/or react to an assessment initiated by COSEWIC, a DFO Recovery Potential Assessment (RPA), a Recovery Strategy, and pre-emptive management measures by DFO. The report would as well provide background to any renewal of a conservation policy for wild Atlantic salmon and inform a government initiated Atlantic Salmon Endowment Foundation.

The first workshop (February 2006, in Moncton; DFO 2006) was limited to DFO and Quebec Province biologists/scientists, as well as a contracted writer/contributor and external reviewers. It addressed most elements within 'Species Information', Section 1.0 Appendix 1. Some sections, however, particularly 1.1.4 'Ecological Significant Units' and those within 1.5 'Population Size', 'Trends', and 'Status' required revisiting. 'Potential for Recovery', and 'Scope for Harm' in Section 1 (Science), as well as 'Threats to the Species', 'Existing Protection', 'Potential Conservation Targets', and 'Significance of the Species' (Fisheries and Aquaculture Management, Habitat Management, Economics, and Aboriginal Affairs, as well as Science) had yet to be addressed. A workshop to conclude discussions begun on these topics in 8 conference calls between September and March was scheduled for March 6-9, 2007, in Dartmouth, Nova Scotia. It consisted of two components:

- March 6-7: At Oakwood House, attended by 11 DFO biologists/scientists (Maritimes, Gulf, and Newfoundland regions, as well as Quebec Province; Appendix 2) engaged in research/assessment of Atlantic salmon, a contracted writer/contributor, and external reviewers from the Pacific Region (1), Central and Arctic Region (1), Dalhousie University (1), and the Atlantic Salmon Federation (1), to address Science issues and challenges within Section 1.0.
- March 8-9: At Marine House, with attendance by an additional 7 other Sector specialists (Fisheries and Aquaculture Management, Habitat Management, and Economics; Appendix 2) representing the above regions and Quebec to deliberate on contributions and text for Sections 2.0-5.0 (Part I), including the landscape for a potential economic assessment (Part II).

Contributions numbered one draft Canadian Scientific Advisory Secretariat (CSAS) Research Document brought forward from the Moncton workshop, two working papers recommended for upgrade to CSAS research documents, an economic background paper, the draft report from the Moncton workshop, tables and brief pieces of text for discussion, a proposed framework for: 1) supporting evidence for Conservation Units, and 2) threats and their degree of harm on loss of spawners, and new sections of draft text targeted for inclusion in the report. The Agenda for discussion and presentations (Appendix 3) generally followed the sequence of the Terms of Reference (Appendix 1), but was guided by the slightly revised structuring (Appendix 4) adopted in the report resulting from the Moncton workshop.

DAY 1

Identifying Population Units for Conservation Below the Species Level (Section 1.1.6)

Presenter: P. O'Reilly
Rapporteur: S. O'Neil

Background: At the Moncton workshop, O'Reilly (2006) noted that there was insufficient knowledge (with the exception of Inner Bay of Fundy) to unequivocally identify meta-population structuring between the species and river-specific population level (DFO 2006). O'Reilly (2006) noted, however, that there is evidence or good reason to believe that structure exists at the resolution of the 35 Salmon Management Areas in Atlantic Canada and quite likely at the watershed level, and perhaps within rivers. Thus, he proposed a process whereby Conservation Units (CUs) could be designated on the basis of a rigorous and systematic assessment of the degree of 'distinctiveness' of all candidate populations of Atlantic salmon in Eastern Canada where 'distinctiveness' reflects the presence of ancestral lineages, and most importantly, the existence of genetically based adaptive differences (O'Reilly 2006).

As an interim measure, it was agreed at the Moncton workshop that the 35 Salmon Management Areas serve as population units for conservation (DFO 2006). In the course of examining some of the biological, ecological, and geographic structure of populations at that workshop however, it became apparent that there were some common characteristics between a few Salmon Management Areas and, therefore, the potential for amalgamation and their possible labeling as interim candidates for CUs. In preparation for the 2007 workshop, it was proposed that the regions and Quebec attempt to move forward the delineation of what were believed to be candidates for CUs by identifying them and documenting the evidence on which a designation was based, a process that was virtually the mirror image of that proposed by O'Reilly (2006).

While the identification of the interim Units had been completed for use in the workshop (Appendix 5), there was need to agree upon an appropriate term for the Units and the evidence needed to support their designation (Section 1.1.6). To this end, O'Reilly led discussion on both issues. The proposed criteria for evidence for distinctiveness were debated and numbered seven: 1) geographic, 2) movement/migration in the context of CUs, 3) genetic marker data, 4) ecological, 5) life history, 6) morphology, and 7) behavior.

Discussion and Conclusions: The most suitable definition of a CU for Atlantic salmon was discussed at length, and a consensus was reached that for the Conservation Status Report for Atlantic salmon, a CU would be defined as: *Groups of individuals likely exhibiting unique adaptations that are largely reproductively isolated from other groups, and that may represent an important component of a species' biodiversity* (reflects minor revision on Day 2). It was noted that the term, at least on the West Coast, has the connotation and function of a 'Conservation Assessment Unit' which is a narrower context than 'Designatable Units' and acknowledges the coarsest scale at which salmon should be managed.

A proposed summary of the evidence supporting the delineation of CUs for the salmon populations of the Maritimes Region was provided and debated with the result that: 1) the columns in the table should be organized in hierarchical order (left to right; strongest to weakest) to reflect significance of evidence for population structuring influences (e.g., pre-glacial refugia> phenotypic characteristics> local geological/ecological effects); 2) life history and related evidence should be placed in a phenotypic evidence category (to include life history,

biological characteristics, morphology, behavior); 3) phenotypic data that is more quantitative should be included for each region (life history and biological characteristic information, e.g., age-at-maturity, gender proportion, smolt age), which will further support the more qualitative information; and 4) geographic and ecological evidence should be merged into a single column. The comments were taken under advisement and a revised table was prepared for discussion at the beginning of Day 2.

The number of CUs proposed for Eastern Canada Atlantic salmon populations is 28 (Appendix 5), down from the 35 Salmon Management Areas proposed as an interim approach during the 2006 CSR workshop. This is supported with the best available evidence and required some changes that were previously based on jurisdictions (e.g., CU 18 and CU 9; the Restigouche River straddles the NB-Quebec border but has now been placed into CU 18).

There was discussion of the potential for salmon populations in a CU to contribute to a rescue of populations nearing extirpation and the importance of identifying the attributes of salmon populations in nearby CUs. There was agreement that the evidence which supports the designation of a CU also supports the premise that fish or populations from neighboring CUs would not easily colonize or effect rescue of another CU. Use of the word 'rescue' was considered to mean aiding the recovery of populations nearing extirpation, not colonizing a river where a population has been extirpated. Given that available evidence supports the premise that widespread distribution of Atlantic salmon in Eastern Canada originated from few pre-glacial refugia, then colonization of areas where populations have been extirpated would be considered to be within the capabilities of the species given enough time. Thus, the number of generations or length of time would have to be taken into account when considering the likelihood of a re-colonization event between neighboring CUs.

Summary of Status and Abundance Trends for Eastern Canadian Atlantic Salmon (*Salmo salar*) Populations

Presenter: A.J.F. Gibson
Rapporteur: P.G. Amiro

Summary: The status of Atlantic salmon populations throughout the Maritimes, Quebec, and Newfoundland and Labrador was summarized by comparison of abundance to the river-specific conservation spawner requirement and by estimating abundance trends (Gibson et al. 2006). The results were revised from an earlier version presented at the Moncton workshop (DFO 2006). Changes included the exclusion of some rivers; changes to spawner requirement in some areas; removal of the summary plot by Salmon Management Area; addition of plots to show time series for abundance; analyses of various methods for estimating declines (changes in the ratio model to allow confidence interval calculation, and comparison to a log linear regression model); substantive changes to the text (qualifying results, highlight sensitivities to selected time period, removal of reference to COSEWIC criteria); and the addition of an appendix of data sources.

Given the wide scope of the analyses and the inter-regional differences in data collection, life history and management, some assumptions were made to ensure comparability. The conclusions from some rivers are sensitive to underlying assumptions, such as the length of the time period over which a trend is calculated, but general patterns among regions and Quebec did emerge. Salmon populations in Salmon Management Areas 20 to 23 (CUs 15, 16, 17; Nova Scotia mainland Atlantic coast and Bay of Fundy rivers) show evidence of strong declines and

are well below their conservation spawner requirement. In contrast, populations in Newfoundland and Labrador have typically been either increasing, or show little recent change in abundance. More variability exists in population trends among rivers throughout Quebec and Gulf of St. Lawrence rivers in the Maritime Provinces. In these areas, some populations show declines but remain above or near their spawner requirement; other populations show increases and others show declines.

Discussion and Conclusions: It was asked if there was an explanation for common patterns that might be adjusted for by a more complex model, or minimally, if it was not important to note changes that have occurred in the data series, particularly the discontinuation of commercial fisheries which at first increased abundance to a peak before declining. Because in-river counts occurred after the commercial fisheries, abundance in the early time period would be underestimated leading to an underestimation of the extent of declines. For example, the Maritimes and Newfoundland patterns are not comparable because returns to Maritime rivers were impacted by closures of the homewater commercial fisheries in 1984, while closures impacting returns to Newfoundland were not initiated until 1992 (the trends analysis started in 1990). The discussion on the declines after the closures led to discussion on whether or not overcompensation occurs in salmon populations. It has not been demonstrated to exist, but potentially could. It was also asked if there was an age-at-maturity influence that may confuse the interpretation of the data (not in Quebec, where there is a suggestion that age-at-maturity is showing signs of decreasing rather than increasing). Results had been presented for large and small salmon separately at the Moncton meeting, during which it was suggested that the analyses be restricted to total abundance. It was also suggested that a log error model could be plotted on a log scale in order to evaluate whether the variance was constant on a log scale (not an assumption of the quasi-likelihood approach used) and that a map of Salmon Management Areas/CUs would be helpful.

One observer noted that this was a first cut analysis of the basic data, but not necessarily the complete picture as other data series (e.g., juvenile abundance) are also available. It was suggested that Figure 14 could serve as an opener for the CSR Section on 'Status' of CUs and that the North American run reconstruction outputs (ICES 2006) that do account for fisheries should as well be included in the introduction to the Section on 'Status'.

A Proposal for Status Indicators, Breakpoint Benchmarks, Status Classifications, and Management Actions for Atlantic Salmon Populations in the Maritimes Region

Presenter: P.G. Amiro
Rapporteur: A.J.F. Gibson

Summary: The author presented a method of evaluating the status of salmon populations based on multiple indicators. In total, 11 indicators were presented and based on the status of a combination of these indicators. Maritime Region CUs were assigned to 1 of 3 categories: 1) recovery actions recommended; 2) adjust human induced mortality; assess threats and review management; or 3) management objectives met. The model was applied to the Southern Upland, Cape Breton Highlands, Cape Breton Lowlands, Inner Bay of Fundy and Outer Bay of Fundy CUs. All but Cape Breton Highlands fell into the category of 'recovery actions recommended'. The Cape Breton Highlands fell into category of 'adjust human induced mortality'.

Discussion and Conclusions: Following the presentation, clarification was sought on 'recruits per spawner' and *lambda;* to which the presenter responded that: 1) recruits are returns to river as opposed to spawner to spawner, so if there are in-river removals, number of spawners per spawner would be less, and 2) *lambda* is the ratio of the population size in a given year to its size in the previous year.

It was suggested that, overall, the approach seemed to be an appropriate way to standardize across rivers. There are, however, many possible indicators and ways to combine, and, thus, it was not clear that these 11 are the most appropriate indicators, or if they are combined in the best way. The author replied that this was the reason for doing the retrospective analysis on the Stewiacke River, i.e., to see whether the output would match the history of management actions on this river; which it did.

Another observer noted that some of the indicators seemed very similar and questioned the difference between 'cohort recruit per spawning salmon (R/S) over one generation' and 'synthetic R/S over one generation'. The response was that the cohort recruit per spawner is calculated by looking forward at the number of spawners produced by a spawner; the synthetic method looks backward to the spawners that produced the existing spawners. Different methods are needed because not all populations have the same kind of data.

It was noted that values were not presented for the most recent years. This was because running averages were used and were assigned to the midpoint of the series (e.g., 3, 5, or 7 years), thus recent data is included in the analysis.

A question was asked about the effect of depensation which is thought to occur in some West Coast salmon populations (e.g., Cass and Wood 1994). The effect of depensation was uncertain, but could potentially be identified as a value of less than one in a stock-recruit model.

It was noted that many indicators compared the most recent year with past state of the indicator. This was done because some of the indicators could indicate large declines (e.g., juvenile densities), whereas others are averaged over longer periods. Trend information is a valuable indicator in itself but as the author pointed out; the variance could as well be used in a range of indicators and could be thought of as fuzzy logic.

One observer suggested that the use of the same benchmarks for CUs where some river populations had been extirpated could be misleading, and that the proportion of rivers in a CU that salmon occupy could be added as an indicator. The proportion of rivers that are occupied could receive a heavier weighting. This is because the loss of a single population is quite significant, but could also skew the view if the loss of a population does not cause a change in the indicators.

One indicator used on the West Coast and worth considering is the distribution of population sizes within the CU. It identifies whether or not declines are greater in small or larger populations, i.e., a decline in all populations versus a decline in just a few large populations.

It was noted that the number of rivers in a CU should also be taken into account. Ideally, this would involve noting the size and number of spawning areas but, since that is not practical, at least the number of rivers could be input for the exercise. For example, the Miramichi could be treated as about 30 rivers as opposed to 1, because the spawners use about 30 major tributaries. The Miramichi River example is not necessarily an example of multiple rivers if it is to be treated as a common management unit, but it could be a different risk management

approach if it was treated as multiple rivers. The author concurred that it would be good to add additional indicators, but the data were not always available.

Questioning then addressed the intended use of the assessment. The author related that it was developed over the previous months and circulated within Science Sector in the hopes of opening a discussion on a common approach to derive values that could be used to assign the status of a population or a CU, and which would address the Terms of Reference of the CSR, specifically 'Status', 'Trajectories', and 'Target for Recovery' (Sections 1.5.4, 1.5.5, and 1.6.1). The comments and suggestions proposed at the workshop will be considered in a review of the document for submission as a CSAS Research Document (endorsed by the group). When asked, representatives from Newfoundland and Labrador Region indicated that they had worked with the template to evaluate their rivers/CUs and would, after some clarification on the mechanics of the calculations, provide tables for inclusion in the final CSAS Research Document.

An observer pointed out that the document suggests that 25% of conservation requirement is a point at which management should terminate all access. This value would conflict with current advice (if in fact being below the conservation limit infers an end to access) and so should be discussed. The author indicated that the discussion would first require the definition of 'recovery' from a DFO perspective.

Status of Atlantic Salmon Stocks in Quebec

Presenter: F. Caron
Rapporteur: R. Randall

Summary: Quebec is divided into 11 CUs, CU 18 to 28, corresponding to salmon zones Q1 to Q11. CU 21 has no/never had salmon rivers. Normally, total salmon runs are composed of two-thirds large salmon (multi-sea-winter) and one-third grilse (1-sea-winter), with the exception of CU 26, where the majority of the stocks are composed of 1-sea-winter fish. In CU 28, Ungava, there are marine and 'estuarine' stocks in some rivers (Robitaille et al. 1986).

In 2000, the Province established a conservation limit (conservation spawner requirement) or minimum egg deposition of 1.67 eggs per unit (m^2) of production. This egg deposition is required on each river in order to attain maximum sustainable yield (MSY) (Caron et al. 1999). The failure to attain this limit reference point for 3 consecutive years effects reductions in allowable mortality in the recreational fishery, progressing from annual quotas on the retention of large salmon, seasonal releases of large salmon, complete releases, and finally closure of the fishery.

In-season counts (where available) and recreational catch statistics (mandatory reporting and 95% compliance) are used to estimate the status of a river population with respect to the attainment of conservation limits. For CUs 18-24, the Province is able to assess the status directly, i.e., estimate egg deposition with respect to requirement; for CUs 25-28 where river counts are not available, abundance and, subsequently, potential egg deposition are based on a relationship between catch-per-unit-effort (CPUE) in those rivers and rivers in CUs 18-20 where egg depositions with respect to CPUE and conservation are known.

The results over the period 2001-2006 (6 years) indicate, with the exception of CU 27 (Anticosti Island), that returns of salmon in the majority of rivers have maintained conservation spawner

requirements. Discharges of rivers on Anticosti Island appear to have declined and are, with the exception of 2 rivers where parr levels are moderate, closed to angling. Exploitation on small populations (those requiring less than 1M eggs) in other CUs is restricted and monitored closely. Subsequently, there has been no need to adopt stricter laws to assure population viability.

Discussion and Conclusions: It was noted that the Kedgwick River flows through New Brunswick, and that the Patapedia and mainstem portions of the Restigouche are provincial boundary waters; and it would be more logical to include the entire Restigouche River with all its tributaries in Quebec's CU 18. As such, the portions of the Restigouche River attributed to CU 9 would be moved to CU 18.

At the conclusion of the presentation, the author presented several summary graphs of population status spanning 20 years, including one on marine survival which diminished with closure of the Newfoundland commercial fisheries in 1992. Adjustment of the data sets to include losses to fisheries prior to 1992 would have indicated even greater declines in survival. It was later recommended (and agreed upon) that these summary graphs be made available for possible inclusion in the CSR.

Status of Atlantic Salmon Stocks in Newfoundland and Labrador

Presenter: B. Dempson
Rapporteurs: R. Randall and J. Loch

***Summary*:** No document was tabled; the CSAS Research Document from the Moncton workshop (Dempson et al. 2006), which included trends in abundance both adjusted and unadjusted for exploitation and smolt-to-adult survival, was judged to be accurate for both the status and trajectories sections of the CSR. For the updated CSR, the Salmon Management Area labels could easily be converted to those of CUs.

***Discussion and Conclusions*:** In discussion, it was indicated that there had been an attempt to examine the Newfoundland Labrador CUs in the context of the multiple indicator framework presented earlier by Amiro and, that with some collaboration, the information might embellish Amiro's proposed CSAS Research Document (page 4). No Category 1 'recovery actions recommended' designations were apparent with the possible exception of a single indicator in CU 6. It was also noted that for some of the CUs, especially Labrador, that the time series was very short.

Another observer noted that it would seem appropriate, at least for the CSR, to prepare a presentation that is consistent among regions and Quebec. It was noted, however, that only one region had a significant problem, and for CUs which were deemed to be meeting reference limits there was little need to do further analysis. That aside, there will be the summary plot of 3 generation change in population abundance for salmon populations in CUs 4-8 (Figure 14; Gibson et al. 2006) putting Newfoundland CUs in the context of those of other regions and Quebec.

Towards a Uniform Approach for the Provision of Advice on 'Status'

Discussion: Group Discussion
Rapporteurs: A.J.F. Gibson and L. Marshall

Subsequent to the review of the Quebec status information proposed for inclusion in the report (percent conservation requirement where obtainable, or comparison of CPUE against a benchmark) and clarification as to the Newfoundland representative's preference for inclusion (excerpts from Dempson et al. (2006), with possibly examples following the multiple indicators), it was again asked if it would be possible to standardize approaches across jurisdictions. The question was asked of the three COSEWIC species specialist committee members as to what weight, if any, they would give to the conservation egg requirements. Because it is a management reference point and not an indicator of extinction risk, its importance would likely be downplayed unless the proportion of attainment was very, very low. This is largely because the COSEWIC process is based on International Union for the Conservation of Nature and Natural Resources (IUCN) criteria which do not include fisheries reference points.

The Chair responded that there were few expectations of a uniform approach at this stage and that since Maritimes Region has stocks which are, or are deemed to be, 'at risk', they wish to include information in the CSR that reflects that status. Other regions and Quebec believe their populations are near conservation or above, i.e., their populations are not 'at risk'. Hence, they are generally summarizing their status in the more traditional sense, and through the absence of much discussion on the multiple indicator proposal prior to the workshop, deferred the debate on uniformity to this meeting. Seeing little movement, it was the hope of the Chair that this discussion would at least set the background for a potential post CSR/pre-COSEWIC assessment in which there might be a better appreciation of the COSEWIC indicators/parameters important to status in a COSEWIC framework.

In summary: Maritimes and Newfoundland regions tested the same proposed multiple indicator assessment; Gulf Region examined multiple indicators in a singular context, and the Province of Quebec resorted to the percentage of conservation and a CPUE proxy of conservation requirements, where necessary. Gulf Region, whose presentation was to follow, had looked at trends in 11 indicators of life stage abundance and percentage of conservation met. One observer suggested that there should be an upfront rationale in the Status Report as to why there are separate approaches to status, aside from the political/philosophical. This might include differences in data (e.g., juveniles, smolts), trade off between indicators, and analysis offered to date.

Salmon Conservation Unit Number 10, Central New Brunswick

Presenter: G. Chaput
Rapporteur: F. Whoriskey

Summary: Salmon populations in this Unit are dominated by those of the Miramichi River for which there is considerable data. There are several other smaller rivers in the Unit where the quantity of data is variable. The organization of the information was largely consistent with the headers, 'Population Size', 'Status and Trends', 'Potential for Recovery', and 'Scope for Harm' of Sections 1.5 and 1.6 and designed for straight forward insertion in the Conservation Status Report.

Abundance, trends, and status for the Miramichi salmon populations were evaluated relative to the period 1992 to 2006; abundance was highly variable and the trend was downwards. Eggs in the returns of adult salmon during the period met or exceeded the conservation requirements in 7 of the 15 years, although conservation requirements had only been met or exceeded in 2 of the last 10 years. Juvenile abundances of all age groups have, however, increased to record highs in both the Northwest and Southwest Miramichi rivers. Estimates of smolt production from the Miramichi River have ranged from 0.6 to 1.5 million fish, a production rate range from just over 1 to over 3 smolts per 100 m^2. The recovery objective was identified as having returns generally at or above the conservation limit on a frequent basis (proposed 8 of 10 years) and based on adults, the Miramichi would not be considered recovered. However, increased abundance of repeat spawners and high juvenile densities indicates that the prognosis for the Miramichi remains positive, and as well indicates room for exploitation within the existing fisheries management plan.

Discussion and Conclusions: Discussion was brief and the group concurred that the approach, which mainly lets the data speak for themselves, was appropriate for the Status Report. The group was mostly comfortable with the different approaches proposed for other regions and Quebec, as they reflected past experience, data availability, and limitations. Key issues do remain in: 1) providing a more uniform overview of the status of Atlantic salmon; 2) developing an ability and/or shedding a reluctance to develop a Population Viability Analyses (PVA) for trajectories; 3) resolution of the present conservation thresholds that are based on a few specific populations at a time of relatively high marine survival; and 4) evaluation of the utility of conservation thresholds that are unlikely to be strictly transportable between many watersheds.

At the conclusion of the discussion, the author tabled similarly framed text, tables, and figures pertaining to CUs 9 (Northern NB, including the Restigouche), 11 (Prince Edward Island), and 12 (Northwestern Nova Scotia). These documents/inserts will be reviewed in the next draft of the Status Report.

DAY 2

Evidence for Designatable Units for Atlantic Salmon: Revised and Revisited

Discussion Leader: L. Marshall
Rapporteurs: S. O'Neil and J. Loch

Summary: In his absence, the Chair tabled P. O'Reilly's over-night revisions to the previous day's table for documenting the evidence for CUs (page 2; this proceedings).

Discussion and Conclusions: The group reviewed the revised captions for the table and offered further comment including use of somewhat less technical language, relabeling in order of strongest to weakest evidence, relabeling the 'Phylogenetic' column to 'Presence of Ancestral Lineage', the combining of three variants of 'Phenotypic' into 'Evidence of Distinctiveness', including movement and migration; retention in the third column of 'Molecular Genetic' but relabeled 'Genetic Structure', and finally, the combining of 'Ecological' and 'Geographic' headers into 'Geographic Disjunction'. In his absence, Patrick O'Reilly was volunteered to complete the first column (Phylogenetic) for all CUs. The column for adjacent population assemblages and footnotes were to stay in the table. The regions and Quebec agreed to

complete the other cells once the revisions have been incorporated and the revised table is circulated. The template with the above revisions appears as Appendix 6.

The definition of a CU (page 2; this proceedings); including three words of clarification developed after this review) and number of CUs as proposed on the map (Appendix 5) remained unchanged.

Trajectories, Target for Recovery, and Recovery Feasibility/Potential (Sections 1.5.5, 1.6.6, and 1.6.2)

Discussion Leader: A.J.F. Gibson
Rapporteur: J. Loch

Summary: Prior to the presentation on equilibrium and PVA models to assess recovery potential, a discussion was invited on 'Trajectories' and 'Target for Recovery' and what text could be provided for the Status Report.

Discussion and Conclusions:

- Trajectories: The opinion was expressed that forecasting the future was an inexact science and need not be explored until such time as COSEWIC had made a designation and a recovery potential assessment was in order. It was countered, however, that trajectories based on current survivals at a range of exploitation rates made the most impact at public consultations and frequently contributed to the adoption of stronger conservation measures. It was noted that, typically, most analyses were probabilistic Monte Carlo simulations designed to provide a range of future possibilities, e.g., Interior Fraser Coho and Sockeye populations. It was suggested that there was adequate data to attempt same on some populations in Maritimes Region. The Chair noted in the absence of any contributions on the topic to the workshop, particularly from CUs in the Maritimes Region which were considered by most to be 'at risk', that a narrative on trajectories would be limited to an overview. Gibson indicated that he could provide some words around a few diagrams.
- Target for Recovery: The Chair provided a list of possible definitions from which it was suggested that a recovery target might be a "population that is producing enough recruits that it is expected on average to have a stable or increasing population and/or, production of recruits that meet some comparative standard with its historical productivity." A more simplistic offering was a "population size/abundance which is sufficiently large to be secure and/or may meet some comparative standard with its historical size" (DFO 2005). The definitions were consistent with the general leanings of the workshop toward the 'reference (conservation) limit' as the best recovery target, i.e., one that has/is being achieved and certainly exceeded in the past. It was cautioned, however, that, e.g., a conservation limit of 2.4 eggs per m^2, may not be the only limit, especially where there is question about its applicability in/transportability to all watersheds and, where in many areas, access to/exploitation of the resource is permitted at less than the conservation limit.

Recovery Potential of Bay of Fundy and Southern Upland Salmon Populations

Presenter: A.J.F. Gibson
Rapporteur: G. Chaput

Summary: The document reviewed the use of a life history based models for evaluating how populations are expected to change in response to human activities. This was followed by four case studies that were used to illustrate the relationship between current threats and recovery potential of salmon in the Maritimes Region: the Big Salmon River and the Tobique River in New Brunswick, and the LaHave River and West River (Sheet Harbour) in Nova Scotia. For each case study, an equilibrium model was constructed to show the present status of the population, as well as the expected effect of recovery actions on the population.

Take home messages from the analyses were:

- Tobique River: Improvement of downstream fish passage survival will do little to effect recovery without an increase in marine survival, but that reduced fish passage survival could limit the effectiveness of other recovery activities or population recovery if marine survival improves.
- LaHave River: Only slightly affected by acidification and requires an increase in marine survival to restore populations to a level above the conservation requirement.
- Big Salmon River: The population is not viable at present; increases in habitat quantity/quality unlikely to effect recovery unless there is a significant increase in marine survival.
- West River Sheet Harbour: Improvements in pH (either prescriptively or naturally) will not restore the population to a level above the conservation requirement unless there is a significant increase in marine survival, but, by increasing survival, may reduce extinction risk and slow declines.

In all cases it was observed, however, that recovery activities focused in fresh water have the potential to slow population decline or maintain populations at low levels until at-sea mortality is resolved.

It was noted that two major impediments exist in determining the recovery potential of Bay of Fundy and Southern Upland salmon CUs. The first was the lack of a comprehensive, river-by-river listing and evaluation of threats to populations. Hence, while the modeling approaches presented could be used to evaluate the activities required for recovery on a population-specific basis, the magnitude of the effort required to effect recovery remained unknown. The second impediment was the inherent assumption that the abundance within populations was adequate to affect a response. The author noted that juvenile salmon populations within the Region were in many cases either absent or very low, and that many rivers had not been surveyed since 2000.

***Discussion and Conclusions*:** A number of points were raised about the suitability of the Beverton-Holt stock and recruitment model, the fit of the assumed model to the data, and alternative models (Ricker and hockey-stick), which could equally explain the observations. The author responded that a detailed analysis of the nature of density dependence had been tabled at the February 2006 workshop that was the basis for model selection, and that in no case did a Ricker provide a better fit than a Beverton-Holt; although the latter was often true. The hockey-stick would provide a different estimate of the slope at the origin which would effect statements about viability, but would not change conclusions about the population response at higher

abundance. There was agreement that all assumptions should be clearly articulated and sensitivities of results described.

The stock and recruitment plots with shading for egg depositions corresponding to different levels of the conservation egg requirements (greater than 100%, 50-100%, and less than 50%) was thought to be confusing by some, given that the important issue is population replacement. Others liked it, in that it placed the dynamics in the context of management of the populations. The characterization of the stock and recruitment curves and the replacement lines to the conservation limit points also illustrates the differences in the present population dynamic and those from which the default conservation limit was originally derived.

The LaHave River stock and recruitment plot (eggs to recruits) suggested two regimes in the dynamic of Atlantic salmon in this river, i.e., before and after the 1986, 1987 egg years (1990-1991 recruit years). It was noted that there was a suggestion of rapid change in sea survival and a sustained lower state of marine survival afterwards and that this change may also apply to other salmon populations in Eastern Canada. This point was not articulated in the discussions to date on 'Status' and should be viewed as an important phenomenon.

It was also suggested that there could be a more direct link to the Inner Bay of Fundy designation and the modeling that had taken place in the past with respect to 'Recovery Potential' for that CU. PVAs exist for the Big Salmon River population that could be referenced.

With regards to case specific examples, it was noted that:

- LaHave River stock and recruitment data consist of egg depositions from all fish (hatchery and wild origin) and 'wild' smolt or wild adults, which result from the combined egg depositions.
- The Tobique River has bypass mortality issues and, as well, the habitat quality or quantity could be affected by the demand-water control processes which result in fluctuations in discharge to supply the Tobique Narrows generating station. Daily fluctuations in discharge can have impacts, presumably in a negative way, on in-stream juvenile salmon survival. As well, the increasing predominance of hatchery origin spawners resultant of smolt releases at Mactaquac with no history in selecting successful spawning locations in a discharge-regulated system could have contributed to less juvenile production than expected.
- Habitat 'quantity' includes not only increases in habitat in terms of square meters or habitat quality, but also the contraction of habitat use by spawners as abundance declines, e.g., as abundance declines, salmon may cluster more such that egg deposition densities in select areas remain unchanged and suffer higher density dependent mortality than if they were distributed across all habitat. This may contribute to the slower rebuilding of salmon from low abundance levels.

One observer noted that the freshwater stage of the life cycle and smolt condition may impact on returning adults, and the need to examine the potential impacts of freshwater stages to later survival at sea.

In summary, it was concluded that the analyses represented a path forward in the evaluation of the effects of multiple stressors on the recovery of populations. Difficulties include the frequent uncertainty about the relative magnitude of threats at the CU level and uncertainties involved in modeling remnant populations. The examples illustrated the magnitude of threats which instinctively might have been quantified at least as to High, Medium, or Low. It was recommended that the manuscript be submitted for inclusion in the CSAS Research Document series.

Marine Mortality as a Stressor: A Discussion

A discussion on marine mortality as a stressor resulted from its somewhat incorrect classification as a threat and the concern that the topic of marine mortality should be strengthened in the revised version of the CSR. It was suggested that there was a need to examine the various hypotheses associated with marine survival in general (most listed and reviewed in Cairns (2001) and O'Neil et al. (2000), where the focus was on the threats common to all salmon production areas), and then apply at the CU level to offer possible explanation(s) for their status, e.g., why the greater decline of multi-sea-winter fish than one-sea-winter fish? Once the threats associated with the reduced survival have been diagnosed, it would then be appropriate to apply equilibrium life history models to examine sensitivity of the fish to habitat changes such as acidification, which could impact on survival in the marine environment, and/or another factor in the estuary, and/or another factor in the marine environment that singly or in combination impact on survival. The analyses should be broad looking for patterns, which if layered on a map might reveal commonalities and gradation over the Eastern Canadian range of the species. It was argued that there should be at least one map showing geographic patterns of marine survival, a narrative description of rate of decline, and regional graphics of pre-fishery and fishery abundance on a map of Eastern Canada. Disappointment was also expressed that no mechanism(s) could be suggested for the reduced marine survival.

Rescue Effect, Time Frame for Recovery, and Scope for Harm (Sections 1.6.3, 1.6.4, and 1.7.1 and 1.7.2)

Presenter: L. Marshall
Rapporteur: J. Loch

The Chair referred to the above topics in the context of the Table of Contents (Appendix 4) and indicated that: 1) rescue effect would be dealt with in a general narrative taking into account recent literature on the implication of genetics; 2) the time frame for recovery could as well be dealt with within the individual write-ups for CUs (although a general discussion towards a consensus would be particularly useful; see discussion Day 4); and 3) scope for harm, where assessed, would be relegated to the narrative for each CU.

In a normal context, scope for harm would be the output of an allowable harm/recovery potential assessment which the CSR is to support in terms of background, but not provide. Southern CUs, in which the status is such that all directed and most bycatch fisheries are closed, intuitively have no scope for harm (human–induced), given the pervasive role of unknown factors in the ecosystem that have reduced marine survival to the point where population replacement is not, or barely being achieved.

Conservation Status Report: Atlantic Salmon in Atlantic Canada and Quebec (Version 3.3, including Sections 1.1-1.7)

Discussion Leader: L. Marshall
Rapporteurs: L. Marshall and J. Loch

Summary: The Chair led the group through the above document previously compiled by Loch Consulting Services from inputs to the February 13-16, 2006, workshop held in Moncton, New Brunswick.

Discussion and Conclusions: The more general points made by workshop participants for the various numbered Sections (Appendix 4) were:

1.1.6: 'Identifying Populations for Conservation Below the Species Level' – inclusion of new text introducing the interim CUs and table of supporting evidence and reconsideration of the existing text given that we have not identified population units for conservation in the manner that was recommended at the Moncton workshop, and inclusion of narrative as to the approach taken.
1.2.3: 'List of Salmon Rivers' – there is need to assist F. Caron in the completion of the list of Canadian Atlantic salmon rivers for inclusion (Caron 2006); the suggestion that frequency distribution plots of the numbers of rivers or populations by size would be instructive.
1.3.1.1: 'Freshwater Habitat Requirements' will be reviewed in light of the upgraded WORKING PAPER from the Moncton workshop, i.e., Amiro (2006); the four pages of tables were, after some considerable discussion, to be reviewed and retained.
1.3.1.2: 'Marine Habitat Requirements' – it was suggested to include, as well, a figure showing outgoing routing, as well as the returning migration of Atlantic salmon; there might also be better references than those of Welch et al. (1995 and 1998) for Pacific Coast linkage between sea temperature and ocean productivity.
1.3.2: 'Habitat Status and Trends' – new information is provided in Amiro (2006).
1.3.2.2: 'Marine Habitat Trends' – there might be better references than Beamish et al. (1993 and 1997) to illustrate a linkage between abundance of Pacific salmon and climate-ocean environment.
1.3.4: 'Identification of Critical Habitat' – it was noted that a Maritimes Region 'Expert Opinion' (Amiro et al. 2006b) had been produced since the Moncton workshop and would be used to revamp this section.
1.3.5: 'Studies Required to Identify Critical Habitat' – again, there was material that could be borrowed from the Inner Bay of Fundy recovery strategy.
1.3.6: 'Identification of Residences' – there would need to be revisions in light of the current interpretation of a residence as having to be 'constructed'; apparently there is some relevant material in a draft Fish Management Habitat Policy?
1.4.1: 'Life Cycle, Population Dynamics, and Reproduction' – it was noted that this section will be embellished based on Chaput et al. (2006).
1.4.2: 'Predation' - to be consistent, this section will be transformed from bullets to narrative, and the table 'Predators of Atlantic Salmon' will be maintained as is.
1.4.3: 'Inter-specific Interactions' will be referenced as Cairns (2001) or O'Neil (2000).
1.4.4: 'Adaptability' – will be checked against O'Reilly (2006).
1.? 'Framework for the Management of Atlantic Salmon Populations' - will be dropped now that CUs have been developed and laid out in Section 1.1.6.
1.5.1: 'Information Sources Sought/Considered' - to be reviewed from the perspective of inclusiveness.
1.5.2/1.5.3: 'Abundance and Recent Trends' – introductory text to a following description of same in 28 CUs; a suggestion to consider logging of the Y-axis in the ICES (2006) pre-fishery

abundance Figure (permits easy determination of parallel versus divergent declines of the two age groups) and possibly, inclusion of historical commercial catch data (with appropriate caveats) from the NASCO implementation Plan as an indicator of previous abundances (numbers of fish preferred to weights). The remainder of Section materials provided in the draft are to be broken into CUs and combined with any new materials (Quebec and Newfoundland-Labrador), deleted in favour of new material for Gulf Region and, in the case of Maritimes Region, embellished with data as appropriate from Amiro et al. (2006a) and Jones et al. (2006) and as later determined, inserted in the CSR in a new section (1.8) with the possible header of 'Population Attributes by Conservation Unit' followed by individual contributions for headers within Sections 1.5, 1.6, and 1.7 (where provided) for each of the 28 CUs.

1.5.4: 'Status' – introductory text, overview, and narrative on single indicators (decline rates and or proportion of conservation requirements met) and multiple indicators including Amiro Table 5 as an example along with Figure 14 from Gibson et al. (2006). The remainder of the overview material is to be struck, while CU specific status narratives are to be moved to Section 1.8: 'Trajectories' – as with 'Status', a short narrative which captures the essence of the workshop discussions is be inserted as an introduction; CU specific trajectories are to be incorporated within CUs in new Section 1.8.

1.5.6: 'Trends in ~~Marine~~ Survival' is to be generalized by dropping 'Marine' and introducing composite materials, possibly from Chaput et al. (2006), Dempson et al. (2006), and O'Connell et al. (2006) illustrating similarities/differences among regions or CUs in survival. Best examples might be smolt to 1-sea-winter and 2-sea-winter salmon. Area and CU specific contributions remaining in 1.5.6 would be moved to new Section 1.8.

1.6.1: 'Expected Target for Recovery' – text had, in the absence of this workshop's discussion, been borrowed from the draft Wild Atlantic Salmon Policy and was not in itself discussed. The thinking was that the overview narrative would reflect the principles within DFO (2005), and an adaptation of the Figure within provided by Amiro which reflected the workshop discussion on the 'position of reference limit points' with respect to at-risk and risk-averse situation.

1.6.2: 'Recovery Feasibility' – to be developed on the basis of discussion at this workshop.

1.6.3: 'Rescue Effect' – to be embellished by inclusion of current thinking by geneticists and the definition of a CU.

1.6.4: 'Expected General Time Frame to Recovery' - text to benefit from discussion at this workshop.

1.7: 'Scope for Harm' – topic largely untouched at the workshop, but can be embellished in a general sense with the experiences from completed 'Allowable Harm Assessments'.

DAY 3

Threats and Degree of Harm (Tabulation - Section 2.1.1 and Section 2.1.3)

Discussion Leader: G. Chaput
Rapporteur: L. Marshall

2.1 Limiting Factors and Threats (domestically and internationally)
- 2.1.1 List of Threats
- 2.1.2 Degree of Harm
- 2.1.3 Aggregate Total Harm

The Chair introduced a table drafted for the purposes of listing for each CU, potential sources of 'permitted' and 'un-permitted' mortality, and as well, documenting jurisdictional 'perspectives' on the degree of harm from each of the sources (Appendix 7). The categories and headers had

been adapted from previously conducted DFO allowable harm assessments and had last been circulated to Steering Committee on January 10, following revisions resultant of the circulation of an earlier draft. The Chair indicated that the 28 CU compilation would appear as a table or an appendix to the CSR, and would at the same time have potential to contribute to summary narratives or possibly figure(s) leading off the respective subsections 2.1.2 and 2.1.3.

Opening comments from the floor included the concern for having to do the exercise for CUs which were in a risk-averse position (most of the 28), the depth of detail to which such a table could go, and conversely the benefit of such a table in highlighting the similarities/differences between CUs in a single document. Through discussion, a consensus was achieved that acknowledged the benefits of the exercise.

Gerald Chaput led a systematic review of the table beginning with the column headers. The most significant advancement was the adoption of a methodology for broadly quantifying the exposure of all salmon in a CU to the threat under consideration, i.e., equal to or greater than 30% would qualify as 'High Impact', 5-30% would qualify as 'Medium Impact', and less than 5% would qualify as 'Low Impact'. An unknown impact was to be reflected as such in the 'Impact' column. This classification system replaced an earlier suggestion that river size might have some utility in the rankings.

High, Medium, and Low categories were as well adopted in the rating of their potential effect on the population (loss of spawners), qualified with a very brief narrative in support of the rating. Examples of appropriate narratives were as well considered within the column delegated for 'Management Alternatives/Mitigation'.

Discussion proceeded on captions for rows, their necessity, their location in the order and their potential to be more or less inclusive, and their ability to represent the issues raised from the floor. Directed and bycatch fishing rows were adjusted according to the flow of discussion, a cumulative row for impact of all fisheries was added and, in quorum, 4 contrasting CUs 19 [Q2], 7 [SFA 13], 15 [SFAs 20 and 21], and 10 [SFA 16] were submitted to test the techniques and appropriateness of supporting explanatory statements. These results were summarized in a revised table for viewing and discussion later that afternoon.

Economic Significance (Section 5.5)

Presenter: D. Liew
Rapporteur L. Marshall

Summary: The document, Atlantic Salmon Economic Significance of the Species, was tabled in order to stimulate discussion background to the provision of content for Section 5.5 of the CSR. It provided a brief perspective of Canadian aquaculture and harvest fisheries in a global setting, a lengthier overview of the varied economic activities in Eastern Canada, and finally a lengthy piece on the economic activities associated with the recreational fishery. The document was introduced as one which was intended to provide the contents of Section 5.5 of the CSR document and, at the same time, a more global treatise with background for Policy and Economics Branch.

Activities linked to 'Economic Significance' included the Aboriginal food, social, and ceremonial fishery, the recreational fishery, the former commercial fisheries, the $30M Atlantic Salmon

Conservation Fund, the conservation initiatives by non-profit organizations, and governments. Non-use values (described below) were as well recognized.

Insight to the activity associated with the recreational fishery was largely based on the 2000 Survey of Recreational Fishing in Canada (the data not yet being completely compiled for the 2005 survey), which, with a special tabulation, revealed data specific to Atlantic salmon in each of the 28 CUs. In 2000, it was estimated that nearly 48,000 anglers expended 435,000 days and some $91M in pursuit of Atlantic salmon. New Brunswick (principally CUs 9 and 10) catered to about 35% of the anglers. Newfoundland and Labrador, followed by Quebec catered to slightly lower percentages of salmon anglers. Quebec, however, generated about 55% of the economic activity; New Brunswick, followed by Newfoundland and Labrador, were each accorded about 20% of the activity. The total expenditure per day fished attributable solely to Atlantic salmon was slightly more than $200. Revenues from license sales were estimated at $1.5M; expenditures by the federal government alone in 2004-2005 were about $12M. No numbers were yet available for non-profit organizations or Aboriginal Peoples.

Discussion and Conclusions: It was suggested that rather than relying on United Nations Food and Agricultural Organization (FAO), the introductory sections on natural distribution, commercial landings, and aquaculture production of Atlantic salmon in this stand-alone report for Policy and Economics Branch would be better served by referencing information from Section 1.0 of the CSR Report and data provided by ICES to the North Atlantic Salmon Conservation Organization (NASCO). The representative from Quebec voiced some concern over the use of the 2000 recreational fish survey, since the number of angler days therein exceeded the sum of the more finite log book data from the various watershed associations. Others indicated that there were as well other more regional economic surveys in or around 2000, but none that replicated the broad brush federal provincial recreational fish survey conducted every 5 years since 1970. The group recommended, however, that other economic/angler surveys should at least be referenced in the document. It was as well noted that the expenditure data did not have a multiplier applied to it; to which the author explained that it would be appropriate for an impact analysis but unwarranted for this background piece.

A general issue was that the 2000 survey coincided with reductions in abundance and angler access and did not reflect the value of salmon fishing as it might have been 20-30 years previous. Participants suggested that minimally, a 'run' be done on the 1985 database, sorting by salmon and province. Another suggestion was to present a provincial total for expenditures for every survey year since 1975, and that fishing effort (fishing days) rather than numbers of fish caught be used as a measure of willingness to pay.

Of further concern to the group was the absence of non-market/use values, i.e., the value to society of knowing that Atlantic salmon inhabited a river, the value of land on a river in which salmon were present or should be present, and reference to the draft national survey (M. Rudd pers. comm.)[1] valuing a number of SARA listed species including Atlantic salmon. It was pointed out that, in addition to expenditures by anglers, there are significant expenditures of person time and resources on restoration and conservation by volunteers. Workshop participants recommended reference to and inclusion in the document of any studies on non-market value and an assessment of societal values including the expenditures by NGOs conserving salmon. It was suggested that the NASCO website offers a bio-economic value of a salmon river, and

[1] M. Rudd, Environmental Valuation and Policy Laboratory, Sir Wilfred Grenfell College, Memorial University Newfoundland, Corner Brook, NL A2H 6P0.

that a recommendation be made within the report to encourage research into non-market, e.g., canoeists, kayakers, and property valuation.

The document also included a significant portion on the expenditures and revenues associated with the 2000 recreational fish survey, past commercial fisheries, etc., which, it was suggested by one observer, was not required to address economic significance of the species. The Chair indicated that he had hoped to provide the economic landscape which, like the 'Threats' section, would be extremely informative to the CSR's broad audience and, at the same time, lay the ground work for any subsequent economic assessment.

Assured that the CSR would extract only key pieces from the tabled document, a detailed discussion of much of the material was avoided. One topic that engendered a significant discussion, however, was a full page Figure entitled "Schema of activities related to Atlantic salmon", which the author had intended to be free of governance issues. There was concurrence that the Figure had the ability to provide a simple overview of the players and their role in the conservation of Atlantic salmon. Blair Holtby offered to neutralize the governance issues by providing revisions for possible inclusion in the CSR.

The absence of a section on the economic significance of Atlantic salmon to the Aboriginal communities was noted. The Chair explained that input to such a section had been sought and delivery was forthcoming.

In light of the discussion, the authors indicated that the next version of this report will be titled along the lines of Background Material for the Atlantic Salmon CSR from which the Chair/those drafting the main CSR report could extract or rearrange whatever pieces they need for the main report. In closing, the authors extended an invitation to all to contribute to those areas in which review and/or data were being sought.

Aboriginal Significance (Section 5.4)

Presenter and Rapporteur: L. Marshall

Summary: In the absence of a representative from Aboriginal Affairs and for completeness of the proceedings, the Chair provided, post-workshop, the elements that he had previously suggested to Aboriginal Affairs should be of value to the report. He proposed that most of the narrative could be found in the draft renewed Wild Atlantic Salmon Conservation Policy. Major topics would be the use of Atlantic salmon for food, social, and ceremonial purposes by more than 40 First Nations and other Aboriginal organizations in Eastern Canada, and the legal context for management of wild Atlantic salmon, which is defined by court decisions respecting Aboriginal and treaty rights. It was as well suggested that guidance from the courts regarding Aboriginal fishing issues be tabled as appropriate.

A table with the headings: 1) Name and Location [by CU]; 2) Approximate Membership; 3) Fishing Agreements with DFO/PQ; 4) Economic Benefits Generated by Salmon; and 5) Funding Contributed by Government and Spent on Salmon Assessment, Conservation, etc., by each First Nation and other Aboriginal organizations was also proposed, so as to provide, in a broad perspective, an awareness of the depth and importance of the species to Aboriginals, and a starting point from which a future economic assessment might be later conducted.

Threats and Degree of Harm from Each: Revisited

Presenter: G. Chaput
Rapporteur: L. Marshall

Summary: The table developed on Day 3 was screen projected for review of the column headers and discussion of the previously unaddressed row headers.

Discussion and Conclusions: Upon resumption, points of clarification were addressed. The remainder of the row captions were reviewed and revised where deemed appropriate. Consensus was then reached that each region and Quebec would endeavour to complete their respective CUs by April 9 for distribution to and review by the CSR Steering Committee.

It was asked who was to lead the populating of the tables to which the Chair suggested that, on the grounds of interest shown to date, Science was the most likely of the sectors capable of delivery. Maritimes Region Science and Habitat representatives expressed the opinion that they might be unable to provide a ranking of threats and degree or level of harm without it first being subjected to regional review. The Chair expressed the view that the narrative introducing the 28 CUs table would indicate that the results were a first cut, qualitative but defendable and originated independently in the separate jurisdictions, and as such constituted a cursory landscape of threats and their relative degree of harm across the 28 CUs.

The concerns of Maritimes Region were again raised at the close of the workshop, with the caveat that they would await the request from the Chair to Steering Committee to complete the task of populating the table. At the same time, the Newfoundland Science representative expressed a concern about leading, and the need to complete the table for CUs which were not in need of recovery. The Maritimes Habitat representative indicated that she was preparing narrative for inclusion in the overview, largely populated to date by Fisheries and Aquaculture Management (Section 2.0). The Chair indicated that he would in the following week, prepare rationale, and circulate the table to the regions and Quebec requesting their support for the project (Appendix 7).

DAY 4

Time Frame for Recovery: Revisited from Day 2

Discussion Leader and Rapporteur: L. Marshall

Discussion and Conclusions: The discussion opened with the suggestion that recovery could be considered to have been achieved when met in 8 out of 10 years. Fisheries managers from the Province of Quebec indicated that they resumed a fishery, or some level of a fishery, if the reference limit point had been obtained, on average, in the 3 previous years. The manager from Newfoundland and Labrador Region indicated that they also used a 3-year time frame in which, on average, 80% of the reference limit point had been achieved. These facts stimulated a discussion about frequency versus time frame for recovery and the limit reference point (2.4 eggs per m^2 in the case of Maritimes Region), which had previously been endorsed by Science as being the recovery target, not some portion of it. The discussion fairly illustrated the difference between Science and Fisheries and Aquaculture Management, where the one could consider that the population is at some risk, while the other considered that there is some scope

for directed harvesting "a contradiction that needs to be resolved independent of how recovery is interpreted" (DFO 2005).

The question was then refocused in the context of SARA or COSEWIC, in which it was the norm for the DFO to perform a 'Recovery Potential Analysis' using a dynamic model and various scenarios of fishing (especially) and natural mortality to ascertain the time required to achieve the defined recovery point. These cases pertained to populations that had been designated/listed and were deemed to be very much different from undesignated/unlisted populations of Quebec, or Newfoundland and Labrador, which were seldom seen as straddling the threatened or cautious-healthy zone described in DFO (2005).

The discussion led to the conclusion that a time frame for recovery would require some quantification, of necessity only be applicable to a population or at best a CU, be virtually impossible to project given the unpredictability of marine survival (assuming that it is the dominating factor prohibiting population growth), and be challenged by fisheries managers who currently have a different interpretation of recovery than that of Science.

Threats, Protection, Targets for Recovery and Significance of the Species: A Review of Previously Prepared Text (Sections 2.0-5.3)

Discussion Leader and Rapporteur: L. Marshall

The Chair provided a quick overview of the topics covered in Sections 2.1 through Section 5.3. Most of it had been assembled by Fisheries and Aquaculture Management or the Chair. The original headers were:

2. Threats to the Species
    - 2.1 Limiting Factors and Threats (domestically and internationally)
        - 2.1.1 List of Threats (including real or potential mortality/harm)
        - 2.1.2 Degree of Harm from each Threat
        - 2.1.3 Aggregate Total Harm/Mortality from Threats and Compare to Allowable Harm to Determine What Level of Mitigation is Needed
    - 2.2 Assessment of Cross-jurisdictional Authorities in Relation to Threats
    - 2.3 Early Identification of Principal Stakeholders in Relation to Threats
3. Existing Protection
    - 3.1 Legislation
    - 3.2 Existing Status Designations (domestically and internationally)
    - 3.3 Management Measures (additional to Section 2.1)
    - 3.4 Recovery Measures Currently in Place
        - 3.4.1 Inner Bay of Fundy (CU 16)
        - 3.4.2 Outer Bay of Fundy (CU 17)
        - 3.4.3 Southern Upland, NS (CU15)
4. Potential Conservation Targets
    - 4.1 Goal of Conservation Measures
    - 4.2 Proposed Species Rebuilding/Habitat Restoration Strategy
    - 4.3 Recommended Actions/Recovery Schedule
    - 4.4 Other Studies Needed

5. Significance of the Species
    5.1 Scientific (endemicity, worldwide status, ...)
    5.2 Ecological (top predator, significant prey item, ...)
    5.3 Social/Cultural

Subsections 2.1.1, 2.1.2, and 2.1.3 were addressed on Day 3 and again subsequent to this discussion (see 'Threats'); Subsection 2.2 still required input. Subsection 3.3 was additional to the original Terms of Reference and the original Subsection 3.3 ('Recovery Measures Currently in Place') was relegated to 3.4, where management measures for each of the 3 at-risk southern CUs (15, 16, and 17) were accorded their own subsection. The subsections 5.4 ('Significance to Aboriginals') was missing, and 5.5 ('Economic Significance') had been dealt with on Day 3. It was explained that much of the material had its roots in 2 unpublished manuscripts: the Canada-NASCO Implementation Plan (Anon. 2006), an unpublished manuscript of the International Affairs Directorate, DFO Fisheries and Aquaculture Management, and an unpublished draft of a renewed Policy for the Conservation of Wild Atlantic Salmon in 2006, which from the perspective of technical correctness had received favourable peer review within the DFO.

Discussion/Recommendations: Many minor points for clarification were raised and noted for edification. Major points of the discussion follow:

Concern was expressed about the inconsistency in Subsection 4.4 'Other Studies Needed', where it was noted that marine survival which appeared through previous sections to be the number one consideration in the reduced abundance of salmon although the Dalhousie workshop (O'Neil et al. 2000) identified freshwater knowledge gaps, as well. Thus, it was proposed that impoundments and acidified waters must be among those parameters in need of research. The point was not debated but warranted the explanation that presently, little field-based habitat research was occurring in the Maritimes Region (which is most affected by dams and acid rain), although some modeling was occurring, and stakeholders had a liming project underway. It was noted that the life of a salmon is a continuum in which the fresh water is a determinant of precocity and permanent residency, time of and size at smoltification, condition, entry to the estuary, etc., which may well play out as determinants in their survival at sea; hence, more research is required in this area.

The Maritimes Region Habitat representative noted the absence of narratives covering habitat related threats amongst the predominantly fisheries management threats, and volunteered to develop same for inclusion in Subsection 2.1. It was also thought that Wayne Fairchild's research out of DFO Moncton could be expanded to provide some quantitative concept of the impact of endocrine-disrupting chemicals on smolts, post smolts, and adults. It was pointed out that, while this can be explored, most tests have been of a laboratory and relatively controlled/exposed nature which would not frequently emulate the kinds of variable and confounding exposure in the wild.

It was noted that for Section 2.2, there was a piece within the earlier mentioned NASCO Implementation Plan that might suffice. As well, it was recommended that literature citation for the draft Wild Atlantic Salmon Conservation Policy be deleted from the text.

Subsection 3.2 came under appreciable scrutiny. The resultant recommendations were to drop references to the Atlantic Canada Conservation Data Centre and the World Wildlife Fund on the basis that they did not have an official status, and to search for provincially legislated 'listings' where they exist (Ontario and elsewhere). In Section 5.1 'Scientific Endemicity', it was as well

suggested that reference to the non-peer reviewed web posting of the status of populations in Northeast Atlantic countries be deleted.

Section 4.0, 'Potential Conservation Targets', was pointed out to be in need of clarification re: the make up of 2-sea-winter and older fish per O'Connell et al. (1997). Elsewhere the term 'recovery' should be clearly disassociated from CUs 15, 16, 17, as they were clearly in need of 'preservation' and stabilization of numbers.

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APPENDICES

Appendix 1. Conservation Status Report (CSR) Terms of Reference

CONSERVATION STATUS REPORT
SARCEP - Terms of Reference (2004)

Context

DFO Species Priority List

What:
- DFO priority list based on biological and socio-economic information

How:
- DFO and other jurisdictions (possibly through CCFAM) would identify priorities for assessment through general status, COSEWIC Priorities etc.

Why:
- Identification of species requiring conservation measures
- DFO staff (potentially in partnership with other jurisdictions) would develop Conservation Status Reports that would form the basis of a COSEWIC status report, allowable harm assessment and recovery strategy
- Allows for the development of annual/regional species work plans to maintain equitable division of labour

Conservation Status Report

What:
- Conservation Status Reports that would form the basis of a COSEWIC status report, allowable harm assessment and recovery strategy
- DFO and not SARA language used
- DFO would subsequently submit COSEWIC status report for consideration (potential for no submission)

How:
- DFO initiates an Assessment (see content below)
- Assessment is reviewed through Advisory Processes (which includes stakeholder participation)
- Enables DFO to implement pre-emptive management measures prior to listing
- Increases transparency & stakeholder involvement in process
- Integrates the SARA process into normal DFO operations
- DFO would use the outcome of this assessment to consult with stakeholders and implement management measures (if possible)

Why:
- Provides ample lead-time to consult with our stakeholders
- DFO would have the information required to prepare for listing
- Provides better info to COSEWIC
- Potentially prevent unnecessary listings
- Decreases duplication of effort

Document Development

This species was identified as a conservation concern through a previous Science peer-review. The species status report was developed by (name) and was reviewed on (date) in (place) (cite CSAS documents).

Drafting of this document was begun on (date) by (DFO or consultant) using existing jurisdictional information. A peer-review meeting was held (date) with representatives from affected jurisdictions, stakeholders (industry, NGOs) and Aboriginal Peoples, to gather further information and discussion. Proceedings of the RAP were published on (date). Comments were incorporated into the present document.

Contents of Conservation Status Report (CSR) — Part 1

Note: The following contains required content of:

- COSEWIC Status Report
- Allowable Harm Assessment Framework
- SARA Recovery Strategy or Action Plan

1. Species Information

Summary introduction of species and rationale for conducting CSR for that species (i.e., rationale and basis for reviewing the conservation status of the species at this time).

1.1 Description of Species
- 1.1.1 Name and Classification
- 1.1.2 Morphological Description
- 1.1.3 Genetic Description
- 1.1.4 Ecologically Significant Units (if applicable)

1.2 Distribution
- 1.2.1 Global Range
- 1.2.2 Canadian Range

1.3 Habitat Considerations
- 1.3.1 Habitat Requirements
- 1.3.2 Habitat Trends
- 1.3.3 Habitat Protection/Ownership
- 1.3.4 Identification of Crucial Habitat (if possible at this point)
- 1.3.5 Studies Required to Identify Crucial Habitat (if needed)
- 1.3.6 Identification of Residence (where applicable)

1.4 Biology
- 1.4.1 Life Cycle and Reproduction
- 1.4.2 Predation (identify main predators)
- 1.4.3 Physiology (e.g., depth, temperature requirements)
- 1.4.4 Dispersal/Migration
- 1.4.5 Inter-specific Interactions
- 1.4.6 Adaptability

1.5 Population Size, Trends, and Uncertainty
- 1.5.1 Search Effort (data sources sought/considered)
- 1.5.2 Abundance
- 1.5.3 Recent/Historical Trends (including natural fluctuation)
- 1.5.4 Potential for Recovery (including recovery feasibility)
- 1.5.5 Rescue Effect

1.6 Scope for Harm
- 1.6.1 Present/Recent Species Trajectory?
- 1.6.2 Present/Recent Species Status?
- 1.6.3 Expected Order of Magnitude/Target for Recovery?
- 1.6.4 Expected General Time Frame for Recovery to the Target?
- 1.6.5 Is there Scope for Harm/Mortality to the Species that Will Not Impede Recovery?
- 1.6.6 What is the Maximum Harm/Mortality that Will Not Impede Recovery?

2. Threats to the Species

2.1 Limiting Factors and Threats (domestically and internationally)
- 2.1.1 List of Threats (including real or potential mortality/harm)
- 2.1.2 Degree of Harm from each Threat
- 2.1.3 Aggregate Total Harm/Mortality from Threats and Compare to Allowable Harm to Determine What Level of Mitigation is Needed

2.2 Assessment of Cross-jurisdictional Authorities in relation to Threats

2.3 Early Identification of Principal Stakeholders in relation to Threats

3. Existing Protection

3.1 Legislation
3.2 Existing Status Designations (domestically and internationally)
3.3 Recovery Measures Currently in Place

4. Potential Conservation Targets

4.1 Goal of Conservation Measures
4.2 Proposed Species Rebuilding/Habitat Restoration Strategy
4.3 Recommended Actions/Recovery Schedule
4.4 Other Studies Needed

5. Significance of the Species

5.1 Scientific (endemicity, worldwide status, ...)
5.2 Ecological (top predator, significant prey item, ...)
5.3 Social/Cultural
5.4 Aboriginal
5.5 Economic

Implementation/Management Considerations

- Once the Conservation Status Report has been drafted, a socio-economic analysis of the contents of the assessment (e.g., proposed conservation targets) is initiated (in consultation with other jurisdictions as needed).

- A regional or national peer-review meeting (RAP/NAP) is planned and convened to review the assessment. This meeting includes clients, sectors, First Nations, and jurisdictions.

- Proceedings and Part 1 of the Conservation Status Report are produced.

- Science (National Headquarters) formally informs operational sectors on outcome of Allowable Harm Assessment (AHA) (Phases 1 & 2).

- DFO Sectors and other jurisdictions (as required) determine how AHA can be implemented (through integrated management plans, MPAs, mitigation measures, and alternative activities to be considered). Includes how to partition harm amongst competing activities.

- Socio-economic analysis and consideration are developed on AHA implementation and impacts of listing.

- Sectoral perspectives are integrated into draft management approach including intent to send status report to COSEWIC.

- Communications strategy is produced (DFO species management strategy and communications plan).

Contents of Conservation Status Report (CSR) - Part 2 - Socio-Economic Report

***Note* This part will be peer-reviewed in a NAP type meeting with all stakeholders/partners included. The results will be combined with Part 1 to produce the final Conservation Status Report.**

Background:
Methodology, assumptions, limitations:
- Identification and description of base case
- Allowable harm assessment/(Fisheries) Management scenarios
- Listing prohibitions; recovery actions

Accounts (as relevant – all may not apply):

1. Fishing:

a. Commercial fishing sector impacts (dependence, economic viability, and income support):
- Total number of fishers:
  - Number of licences, permits, enterprises, vessels, persons employed.
- Identification of fisheries where there is bycatch.
- Percentage of income attributed to species (dependency).
  - Crew members affected.
- Geographical distribution of affected licence holders.
- Income Support: Number of EI recipients by area; average amount awarded by area.
- Price trends (landed price and market price per pound by area).
- Fishing enterprises (number, revenue, costs).
- Other sources of income.

b. Recreational fishing sector impacts:
- Total landings, by area.
- Profile of activities affected (employment, value).

c. Processing Sector:
- Plants processing species.
    - Quantity processed.
    - Location (geographical distribution).
    - Cod as a percentage of total processed (dependency, viability).
    - Value added.
    - Employment, EI.

2. First Nations Impacts:
- Fishing (communal licences, food, social, and ceremonial allocations).
- Employment, income.
- Economic development impacts.

3. Impacts to Other Industries (this may require partnering with provinces for information):
- E.g., agriculture, mining, electricity, oil and gas, tourism, etc.
    - Activity, production and viability, revenue, wages, employment, costs and net returns.

4. Habitat Enhancements

5. Social Impacts:
- Community profiles (employment, demographic trends, etc.).
- Regional development.

6. Government:
- Sectors (federal, provincial, municipal).
- Revenues (e.g. taxes), costs (e.g. Science).

Departmental Recommendation/Proposed Action Plan

- Decision is made on whether to send a species status report to COSEWIC:
    - If yes, DFO implements management measures prior to COSEWIC listing.
- Relevant sectors consult with jurisdictions, Wildlife Management Boards, First Nations, and clients as required.
- Implementation of management approach includes promoting stewardship and developing tools/process/system to monitor success or the impact of management measures.

Appendix 2. CSR Workshop Participants

Attendees: Workshop on Conservation Status of Atlantic Salmon, Part 2, Oakwood and Marine House, Dartmouth, Nova Scotia – March 6-9, 2007.

NAME	ORGANIZATION	ADDRESS	E MAIL/DATES OF ATTENDANCE
Peter Amiro	DFO Science MAR Region	Dartmouth NS	AmiroP@mar.dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Paul Bentzen	Dalhousie University.	Halifax NS	Paul.Bentzen@dal.ca 6th, 7th, 8th & 9th
Chuck Bourgeois	DFO Science NFL Region	St. John's NF	BourgeoisC@dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Mike Calcutt	DFO Fish. Manage. NC Region	Ottawa ON	CalcuttM@dfo-mpo.gc.ca 8th & 9th
Francois Caron	Faune Quebec MRNF	Quebec City PQ	Francois.caron2@mrnf.gouv.qc.ca 6th & 7th
Gerald Chaput	DFO Science GU Region	Moncton NB	ChaputG@dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Brian Dempson	DFO Science NFL Region	St. John's NF	DempsonB@dfo-mpo.gc.ca 6th, 7th & 8th
Jamie Gibson	DFO Science MAR Region	Dartmouth NS	GibsonAJF@mar.dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Blair Holtby	DFO Science PAC Region	Sidney BC	HoltbyB@pac.dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Doreen Liew	DFO Economics MAR Region	Dartmouth NS	LiewD@mar.dfo-mpo.gc.ca 8th
John Loch	Consultant	Bedford NS	Lochonsult@ns.sympatico.ca 6th & 7th
Maurice Mallet	DFO Fish. Manage. GU Region	Moncton NB	MalletMO@dfo-mpo.gc.ca 8th & 9th
Monica MacLellan	DFO Economics MAR Region	Dartmouth NS	MacLellanM@mar.dfo-mpo.gc.ca 8th
Larry Marshall (Chair)	DFO Science MAR Region	Dartmouth NS	MarshallL@mar.dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Shane O'Neil	DFO Science MAR Region	Dartmouth NS	ONeilS@mar.dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Patrick O'Reilly	DFO Science MAR Region	Dartmouth NS	OReillyP@mar.dfo-mpo.gc.ca 6th
Rebecca Poole	DFO Science NFL Region	St. John's NF	PooleR@dfo-mpo.gc.ca 6th, 7th & 8th
Bob Randall	DFO Science C&A Region	Burlington ON	RandallR@dfo-mpo.gc.ca 6th, 7th, 8th & 9th
Dave Reddin	DFO Science NFL Region	St. John's NF	ReddinD@dfo-mpo.gc.ca 6th, 7th & 8th
Berkley Slade	DFO Fish. Manage. NFL Region	St. John's NF	SladeB@dfo-mpo.gc.ca 8th & 9th
Serge Tremblay	Faune Quebec MRNF	Quebec City PQ	Serge.Tremblay@mnrf.gouv.qc.ca 6th & 7th
Geoff Veinott	DFO Science NFL Region	St. John's NF	VeinottG@dfo-mpo.gc.ca 6th, 7th & 8th
Jennifer Voutier	DFO Habitat MAR Region	Dartmouth NS	VoutierJ@mar.dfo-mpo.gc.ca 8th & 9th
Fred Whoriskey	Atlantic Salmon Federation	St. Andrews NB	asfres@nbnet.nb.ca 6th, 7th, 8th & 9th

Appendix 3. Draft Agenda

DRAFT AGENDA

Conservation Status Workshop (Atlantic salmon)
Oakwood House (March 6-7, 2007) and Marine House (March 8-9, 2007)

Dates and Times	Topics
Tuesday March 6	
9:00 AM-	'Units' for conservation and evidence of
(inc health brk)	distinctiveness (Sec 1.1; esp. Sec 1.1.4)
12:00 noon	Working Table; O'Reilly lead
12:00-1:00	Lunch (provided)
1:00 PM-	Update Spp status/benchmarks Sec 1.5.4 Gibson Res. Doc.
(inc health brk)	Multiple indicators of status & benchmarks: Amiro WP
5:00	Regional/PQ (PQ WP inc.) inputs
Wednesday March 7	
9:00 AM-	[Trajectories], [Potential for Recovery] & [Scope for Harm]
(inc health brk)	(Sec. 1.5.5, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 1.7.1 & 1.7.2)*
12:00 noon	Gibson WP (not yet available)/Maritimes lead
12:00-1:00	Lunch (provided)
1:00 PM-	Review and recommendations re: text for Sections
(inc health brk)	1.1 through 1.5.3 (bulk of document produced Feb 2006)
5:00	
Thursday March 8	
9:00 AM-	Threats and tabulation, (Section 2.0); Regional/PQ leads
(inc health brk)	
12:00 noon	
12:00-1:00	Lunch (provided)
1:00 PM-	Economic Significance, (Sec. 5.5) Maritimes lead
(inc health brk)	Aboriginal Significance (Sec. 5.4) Maritimes lead
5:00	
Friday March 9	
9:00 AM-	Review and recommendations re: draft text for
(inc health brk)	Sections 2.0 through 5.3 (similar file name)
1:00 PM	

* use Section numbering in TOC of 'CSR Draft #1 v3.3.rev.doc'

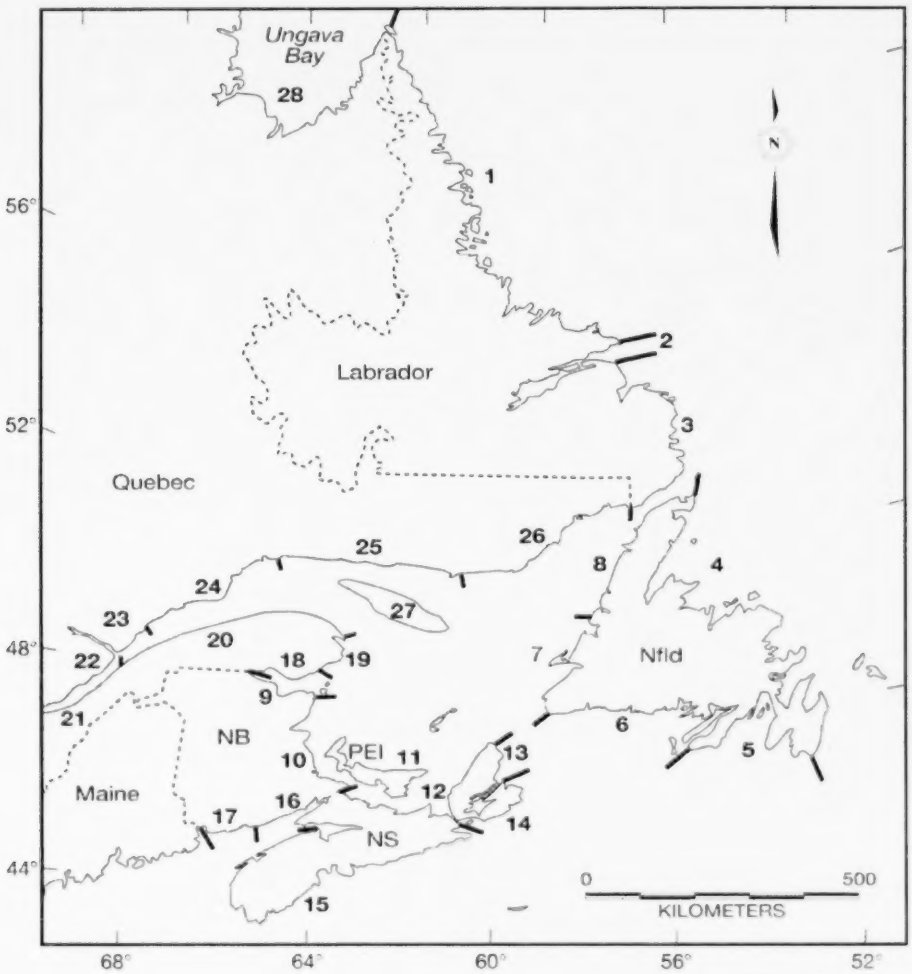
Appendix 4. Table of Contents Resultant of the Moncton Workshop, February 2006

Executive Summary
Table of Contents
Introduction
1. Species Information
1.1 Description of Species
1.1.1 Name and Classification
1.1.2 Morphological Description
1.1.3 Biogeography
1.1.4 Genetic Description (5) leave as in Loch's text
1.1.5 Population Structuring
1.1.6 Identifying Population Units for Conservation Below the Species Level
1.2 Distribution
1.2.1 Global Range
1.2.2 Canadian Range (past and present)
1.2.3 List of Salmon Rivers in Canada
1.3 Habitat Considerations
1.3.1 Habitat Requirements
1.3.1.1 Freshwater Habitat Requirements
1.3.1.2. Marine Habitat Requirements
1.3.2 Habitat Status and Trends
1.3.2.1 Freshwater Habitat Trends
1.3.2.2 Marine Habitat Trends
1.3.3 Habitat Protection/Ownership
1.3.4 Identification of Critical Habitat
1.3.5 Studies Required to Identify Critical Habitat
1.3.6 Identification of Residence
1.4 Biology
1.4.1 Life Cycle, Population Dynamics, and Reproduction
1.4.2 Predation
1.4.3 Inter-specific Interactions
1.4.4 Adaptability
1.? Framework for the Management of Atlantic Salmon Populations
1.5 Population Size, Status, and Trends
1.5.1 Information Sources Sought/Considered
1.5.2/1.5.3 Abundance and Recent Trends
1.5.4 Status
1.5.5 Trajectories
1.5.6 Trends in Marine Survival
1.6 Potential for Recovery
1.6.1 Expected Target for Recovery
1.6.2 Recovery Feasibility
1.6.3 Rescue Effect
1.6.4 Expected General Time Frame for Recovery
1.7 Scope for Harm
1.7.1 Is there Scope for Harm/Mortality to the Species that Will Not Impede Recovery?
1.7.2 What is the Maximum Harm/Mortality that Will Not Impede Recovery?
2. Threats to the Species
2.1 Limiting Factors and Threats (domestically and internationally)
2.1.1 List of Threats (including real or potential mortality/harm)
2.1.2 Degree of Harm from each Threat
2.1.3 Aggregate Total Harm/Mortality from Threats and Compare to Allowable Harm to Determine What Level of Mitigation is Needed
2.2 Assessment of Cross-jurisdictional Authorities in relation to Threats
2.3 Early Identification of Principal Stakeholders in relation to Threats

3. Existing Protection
   3.1 Legislation
   3.2 Existing Status Designations (domestically and internationally)
   3.3 Recovery Measures Currently in Place
4. Potential Conservation Targets
   4.1 Goal of Conservation Measures
   4.2 Proposed Species Rebuilding/Habitat Restoration Strategy
   4.3 Recommended Actions/Recovery Schedule
   4.4 Other Studies Needed
5. Significance of the Species
   5.1 Scientific (endemicity, worldwide status, ...)
   5.2 Ecological (top predator, significant prey item, ...)
   5.3 Social/Cultural
   5.4 Aboriginal
   5.5 Economic

Glossary
References

Appendix 5. Location of the 28 Proposed Conservation Units in Eastern Canada



Legend: Proposed CU Compilation

1 North Labrador
2 Lake Melville
3 South Labrador
4 Northeast Coast
5 Southeast Coast
6 Southwest Coast
7 Southwest Coast
8 Northwest Coast
9 N. New Brunswick
10 Central New Brunswick
11 Prince Edward Island
12 Northwestern NS
13 Cape Breton E. Uplands
14 Cape Breton E. Lowlands
15 Southern Uplands
16 Inner Bay of Fundy
17 Outer Bay of Fundy
18 Salmon Zone Q1
19 Salmon Zone Q2
20 Salmon Zone Q3
21 Salmon Zone Q4
22 Salmon Zone Q5
23 Salmon Zone Q6
24 Salmon Zone Q7
25 Salmon Zone Q8
26 Salmon Zone Q9
27 Salmon Zone Q10
28 Salmon Zone Q11

Appendix 6. Proposed Conservation Units and Some Examples of Supporting Evidence

Proposed CU	Nearby candidate CU	Evidence for CU designation			
		Presence of unique lineage(s)[1]	Evidence of distinctiveness (Phenotypic information[2] and movement[3])	Genetic structure[4]	Ecological[5] and geographic structure[6]
1 North Labrador ND	2,28				
2 Lake Melville	1,3				
3 South Labrador	2,8,26			-boundary between CU 3 and CU 26 approximately corresponds with boundary between Ungava/Labrador and Gulf groupings based on allozyme information in Verspoor (2005).	
4 Northeast Coast	5,8				
5 Southeast Coast	4,6				
6 Southwest Coast	5,7,13,14				
7 Southwest Coast	6,8				
8 Northwest Coast	4,7,26				
9 N. New Brunswick NB	10,18				
10 Central New Brunswick	9,11,12				
11 Prince Edward Island PEI	10,12				
12 Northwestern N.S.^NS	10,11,13				
13 Cape Breton E. Uplands	6,12,14	N/A	-N/A -N/A	-little information available on mtDNA, allozyme or microsatellite markers for CBL and CBH populations	-CBU rivers typically of higher gradient than CBH rivers 1) separated by <10 kms 2) no disjunction 3) no physical barriers
14 Cape Breton E. Lowlands	6,13,15	-N/A	-N/A -N/A	-little information available on mtDNA, allozyme or microsatellite markers for CBL and CBH populations	-CBL rivers typically of lower gradient than CBH rivers 1) 10's of kms from SU but <10 km from CBH rivers 2) possible disjunction between

Proposed CU	Nearby candidate CU	Evidence for CU designation			
		Presence of unique lineage(s)[1]	Evidence of distinctiveness (Phenotypic information[2] and movement[3])	Genetic structure[4]	Ecological[5] and geographic structure[6]
					CBL and SU (SU populations geographically close then large break to nearest CBL salmon bearing R); no disjunction between CBL and CBH rivers 3) CBL and SU separated by Strait of Canso and Chedabucto Bay; no barriers separating CBL and CBH rivers; no barriers between CBL and CBH rivers
15 Southern Uplands	**14,16**	-mtDNA haplotype not observed in adjacent population but do not know if globally endemic Verspoor, (unpubl.)	**-N/A** **-N/A**	-mtDNA haplotypes observed in SU but not iBoF and vice versa; mtDNA haplotypes seen in SU salmon not seen in CBL and other nearby populations though information from N populations limited (Verspoor, technical report) -SU salmon cluster separately from iBoF and CBL at allozyme loci and identified by authors as a distinct grouping (Verspoor et al. 2005) -SU populations largely group separately from iBoF populations at microsatellite loci surveyed (O'Reilly, unpublished data); limited microsatellite information available for SU-CBL comparisons	-high incidence of acidified rivers within the SU relative to the iBoF and CBL 1) 10's of kms from iBoF and CBL rivers 2) possible disjunction between SU and iBoF (possible disjunction, few salmon bearing streams on SE shore of B of F, between Gaspereau and Annapolis Rivers), possible disjunction between SU and CBL (SU populations geographically close then large break to nearest CBL salmon bearing R) 3) , iBoF deeper within the Bay of Fundy; iBof deep inside BoF and largely internal to Cape Split and very high tides; SU and CBL separated by Chedabucto Bay and Strait of Strait of Canso

Proposed CU	Nearby candidate CU	Evidence for CU designation			
		Presence of unique lineage(s)[1]	Evidence of distinctiveness (Phenotypic information[2] and movement[3])	Genetic structure[4]	Ecological[5] and geographic structure[6]
16 Inner Bay of Fundy	**15,17**	-unique mtDNA haplotype one mutation from a common NA variant suggestive of possible refugium for iBoF salmon (Verspoor, 2002)	-higher incidence of maturation after one sea-winter in iBoF relative to oBoF and SU salmon (Amiro 2004) - distribution of tags returns from marine environment differs between iBoF and oBoF (Amiro 2004) -distribution of tags returns from marine environment differs between iBoF and SU (Peter, reference needed and please confirm) -distribution of tags returns from marine environment differs between SU and iBoF (Peter, reference needed and please confirm)	-mtDNA lineage at high frequency in iBoF not observed elsewhere in global distribution of the species, including oBoF and SU (Verspoor et al. 2002) - iBoF salmon group separately from oBoF and other populations at multiple allozyme loci and considered a distinct regional grouping by authors (Verspoor et al. 2005) -oBoF and nearby Chignecto Bay iBoF populations very similar microsatellite allele frequencies (O'Reilly unpub) -iBoF populations largely group separately from SU populations at microsatellite loci surveyed (O'Reilly, unpublished data)	-N/A 1) 10's of kms from oBoF and SU rivers 2) no obvious disjunction between iBoF and oBoF rivers; possible disjunction between iBoF and SU salmon (few salmon bearing streams on SE shore of B of F, between Gaspereau and Annapolis Rivers). 3) oBoF at the entrance of the Bay of Fundy, iBoF deeper within the Bay of Fundy; iBof deep inside BoF and largely internal to Cape Split and very high tides
17 Outer Bay of Fundy	**16**	**-N/A**	-lower incidence of maturation after one sea-winter than in iBoF (Amiro 2004) - distribution of tags returns from marine environment differs between iBoF and oBoF (Amiro 2004)	-oBoF and iBoF salmon exhibit very different mtDNA haplotype frequencies (see iBoF-oBoF for more details) (Verspoor et al. 2002) -oBoF salmon group separately from iBoF and most other populations at multiple allozyme loci and	-N/A 1) 10's of kms from iBoF 2) no obvious disjunction between iBoF and oBoF rivers 3) oBoF at the entrance of the Bay of Fundy, iBoF deeper within the Bay of Fundy

Proposed CU	Nearby candidate CU	Evidence for CU designation			
		Presence of unique lineage(s)[1]	Evidence of distinctiveness (Phenotypic information[2] and movement[3])	Genetic structure[4]	Ecological[5] and geographic structure[6]
				are considered a distinct regional grouping by the authors (Verspoor et al. 2005) -oBoF and nearby Chignecto Bay iBoF populations very similar microsatellite allele frequencies (O'Reilly unpubl.)	
18 Salmon Zone Q1 QU	**9,19**				
19 Salmon Zone Q2	**18,20**				
20 Salmon Zone Q3	**19,21,27**				
21 Salmon Zone Q4	**20,22**				
22 Salmon Zone Q5	**21,23**				
23 Salmon Zone Q6	**22,24**				
24 Salmon Zone Q7	**23,25**				
25 Salmon Zone Q8	**24,26,27**				
26 Salmon Zone Q9	**3,8,25**				
27 Salmon Zone Q10	**20,25**				
28 Salmon Zone Q11	**1**				

Footnotes:

[1] Information indicating the presence of unique or distinct lineages within the proposed CU, including evidence of distinct refugial (glacial) origins, reciprocal monophyly at mtDNA, etc.).

[2]Presence of observable differences including morphological, meristic, life history (egg size, age at smoltification, sea age, etc.) for which there is evidence that the character(s) in question are adaptive (are genetically based and confer a fitness advantage). Note: include information on the strength of evidence for adaptiveness of the trait(s)

[3]Movement information includes tagging, telemetry or other data pertaining to movement that could indicate distinctiveness

[4]Information from 1) presumably neutral molecular genetic markers such as microsatellites, mtDNA, AFLPs, allozymes., etc., that indicate the presence of largely reproductively isolated groups of organisms, and 2) frequency or fixed differences at MHC and other coding loci that may be adaptive

[5]Ecological differences between environments occupied by proposed units that may have led to the development of adaptive differences, including stream gradient, river sizes, temperature regimes, general water quality differences (pH), bedrock types, prey types, predators, etc. for which local adaptation could occur that would lead to distinctiveness

[6]Includes 1) geographic distance between proposed units, 2) geographic disjunction (yes/no) and 3) presence of physical barriers

ND-Newfoundland and Labrador
NB-New Brunswick
NS-Nova Scotia
PEI-Prince Edward Island
QU-Quebec
N/A-Not Available (should not necessarily be considered as negative evidence)

Appendix 7. Row and Column Headers for Table Summary of Threats and Rated Effects Degree of Harm including Evolving Caption for Table:

e.g., 'Summary of Threats and ~~Rating of Effects~~ Degree of Harm on Conservation Unit recovery and/or persistence.' See Annex 1 and Annex 2 (end of table) for preliminary examples.

Potential sources of mortality/harm Permitted and un-permitted activities	Source (*with examples*)	Proportion of salmon in CU affected (LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN)	Cause/Time Frame Historic (H) Current (C) Potential (P)	~~Effect~~ Harm ~~on~~ to Population ~~Recovery/Persistence~~ (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/mitigation (relative to existing actions)
Directed Salmon Fishing	Aboriginal				
	Recreational: retention & release				
	Commercial (domestic)				
	High Seas (West Greenland/St. Pierre – Miquelon)			-	
	Illegal (poaching)				
	CUMULATIVE EFFECT			-	
Bycatch of Salmon in Fisheries for Other Species	Aboriginal				
	Recreational				
	Commercial near-shore				
	Commercial distant				
	CUMULATIVE EFFECT				
Salmon Fisheries Impacts on Salmon Habitat	Aboriginal				
	Recreational				
	Commercial				
	Illegal				
	CUMULATIVE EFFECT				
Mortality Associated with Water Use	Power generation at dams & tidal facilities (turbine mortalities, entrainment, stranding)				
Habitat Alterations	Municipal waste water treatment facilities				
	Pulp & paper mills				

Potential sources of mortality/harm Permitted and un-permitted activities	Source (*with examples*)	Proportion of salmon in CU affected (LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN)	Cause/Time Frame Historic (H) Current (C) Potential (P)	~~Effect~~ Harm ~~on~~ to Population ~~Recovery/Persistence~~ (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/mitigation (relative to existing actions)
	Hydroelectric power generation (dams & reservoirs, tidal power): altered behavior & ecosystems				
	Water extractions				
	Urbanization (altered hydrology)				
	Infrastructure (roads/culverts) (fish passage)				
	Aquaculture siting				
	Agriculture/Forestry/Mining, etc.				
	Municipal, provincial & federal dredging				
	CUMULATIVE EFFECT				
Shipping, Transport and Noise	Municipal, provincial, federal & private transport activities (inc. land and water based contaminants/spills)				
Fisheries on Prey of Salmon (for ex. capelin, smelt, shrimp, ...)	Commercial, Recreational, Aboriginal fisheries for species a, b, c etc.				
Aquaculture (Salmon and other species)	Escapes from fresh water, marine facilities, disease, parasites, competition, effects on behaviour and migration , genetic introgression				

Potential sources of mortality/harm Permitted and un-permitted activities	Source (*with examples*)	Proportion of salmon in CU affected (LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN)	Cause/Time Frame Historic (H) Current (C) Potential (P)	~~Effect~~ Harm ~~on~~ to Population ~~Recovery/Persistence~~ (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/mitigation (relative to existing actions)
Fish culture/stocking (non-commercial, including private, NGO, government)	Impacts on effective population size, over representation of families, domestication				
Scientific Research	Government, university, community and Aboriginal groups				
Military Activities	Field operations, shooting ranges,				
Air Pollutants	Acid rain				
UN-PERMITTED					
Introductions of non-native/invasive species	Smallmouth bass, chain pickerel, muskellunge, rainbow trout, invertebrates, plants, algae				
International High Seas Targeted	Flags of convenience?				
Ecotourism and Recreation	Private Companies & public at large (water crafts, swimming, etc) effects on salmon behaviour and survival				
Ecosystem change	Climate change, changes in relative predator/prey abundances, disease				

ANNEXES

Annex 1: Example of Threats and Effects Analysis for Four Conservation Units

Potential sources of mortality/harm Permitted and un-permitted activities	Source (*with examples*)	Proportion of salmon in CU affected (LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN)	Cause/Time Frame Historic (H) Current (C) Potential (P)	Effect on Population Recovery/Persistence (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/mitigation (relative to existing actions)
Directed Salmon Fishing CU 19 (Q2)	Recreational: retention & release	**MEDIUM HIGH**	**Current**	**LOW** Pre-season and in-season management plans control exploitation based on status; objective to meet or exceed Conservation limits (CL) generally achieved	Increase use of catch and release measures, direct effort controls, and season modifications
Directed Salmon Fishing CU 7 (SFA 13)	Recreational: retention & release	**MEDIUM**	**Current**	**LOW** Most rivers meeting or exceeding CLs, and river-specific rebuilding plans in place to meet river-specific CLs have resulted in reduced exploitation rates	Reductions in retention fisheries; increase use of catch and release measures; direct effort controls; season modifications, and closures
Directed Salmon Fishing CU 15 (SFA 20&21)	Recreational: retention & release	**LOW MEDIUM** Most rivers closed, short season on open rivers	**Current**	**LOW** Most rivers closed to salmon fishing, and catch and release only in a few rivers with short season	Shortened seasons and additional fishery closures
Directed Salmon Fishing CU 10 (SFA 16)	Recreational: retention & release	**MEDIUM HIGH** Season open from April 15 to Oct. 15, high effort	**Current**	**LOW MEDIUM** About 6% egg loss due to retention of grilse; catch and release mortality on large salmon, and smaller southeast NB rivers are closed to salmon fishing	Reductions in seasonal retention limits for grilse; reductions in daily catch and release limits, and modifications to seasons and areas

Annex 2: Example of Threats and Effects Analysis for Directed Salmon Fishing for Conservation Unit 10

Potential sources of mortality/harm Permitted and un-permitted activities	Source (*with examples*)	Proportion of salmon in CU affected (LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN)	Cause/Time Frame Historic (H) Current (C) Potential (P)	Effect on Population Recovery/Persistence (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/mitigation (relative to existing actions)
Directed Salmon Fishing CU 10 (SFA 16)	Aboriginal	**LOW MEDIUM** Allocations less than 10% of fish in CU	**Current**	**LOW MEDIUM** Lower relative allocations for MSW salmon than for grilse, and total allocations remove less than 10% of eggs	Reductions in MSW salmon allocations; greater use of live trap fishing gear for selective harvest of size groups, and access considerations relative to stock status
	Recreational: retention & release	**MEDIUM HIGH** Season open from April 15 to Oct. 15, high effort	**Current**	**LOW MEDIUM** About 6% egg loss due to retention of grilse; catch and release mortality on large fish, and smaller southeast NB rivers are closed to salmon fishing	Reductions in seasonal retention limits for grilse; reductions in daily catch and release limits, and modifications to seasons and areas
	Commercial (domestic)	**Not Applicable** Commercial fisheries in eastern Canada closed	**Historic**	**NONE**	
	High Seas (West Greenland/St. Pierre – Miquelon)	**LOW** Fisheries restricted to internal consumption requirements	**Current** (Tagged smolts/bright salmon reported from West Greenland fishery)	**LOW** Harvests less than 5% of eastern Canada returns, and several months of subsequent marine mortality before return to rivers	Reductions in internal use fisheries in those areas

	Illegal (poaching)	**UNCERTAIN** Guess-estimates as high as 10% of CU abundance	**Current**	**UNCERTAIN**	Additional enforcement, additional headwater protection areas; education initiatives, and increased penalties for illegal activity prosecutions
	CUMULATIVE EFFECT	**HIGH**	**Current**	**LOW MEDIUM** Cumulative losses between 10 and 15%; restricted fisheries on MSW salmon bearing eggs; rivers have achieved CLs in a few years in last 10 years, and indices of freshwater production remain at high levels	In-river fisheries account for largest proportion of egg losses; management alternatives to reduce losses are possible